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PELORIA IN VIOLA PRIMULAEFOLIA LINN.

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Peloria in *Viola* is not a new phenomenon. It was recorded as early as 1775 when Leers* described his observations on plants of *Viola odorata*. A few years later M. Colladon-Martin† recorded a similar observation in *Viola hirta*. Both of these violet species happen to be European forms. Apparently no American species has ever been recorded producing this singular phenomenon, notwithstanding the existing great wealth of varieties and diversity of environmental conditions on the American continent.

Peloric flowers in *Viola* have been described as being of two forms, viz., those that are complete in their transformation and those that are incomplete, but as no mention was made of any other teratological phenomena being correlated with the change in the form of the flowers, we assume that those specimens that were reported represent merely cases of simple peloria.

An unusually interesting case of peloria was discovered in a *Viola primulaefolia* Linn. plant in 1912 which not only produced flowers with all of the various forms of peloria represented but in addition and correlated with this phenomenon appeared a radical change in the type of the flowers, viz., one of a general reduction and a tendency toward a numerical uniformity in the constituent parts of all of the floral whorls. The normal violet flower, as is well known, consists essentially of five sepals, five petals, a five stamen androecium and a three carpellary pistil, while the flower of this newly discovered plant in its extreme peloric form consists of a four-parted calyx, a four-

* Flor. herbörn., p. 145.

† D. C. Organ. veget., t. 1, p. 519, pl. XLV.

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parted corolla, a four-parted androecium, and a four carpellary pistil. Thus the typical form of the violet flower has been changed to one that is not only perfectly regular but also uniform in all of its parts.



FIG. 1. A plant of *Viola primulaefolia* Linn. bearing the modified flowers.

The original plant bearing these unique flowers was discovered in May, 1912, on the bank of Rocky Branch at West Raleigh, North Carolina, and it proved to be the only plant, among hundreds of others of the same species, that exhibited this peculiarity. Most of the flowers were peloric in form but the majority of them were of the incomplete type. The evidence then at hand suggested that a new regular violet flower, one

composed of four sepals, four petals, four stamens and four carpels, was in the process of formation. Such flowers have later been obtained and a truly new type of violet realized.

A detailed description of the normal violet flower together with a brief description of the complete and incomplete peloric forms and their correlation with other characters will now be given.

DESCRIPTION OF THE NORMAL VIOLET FLOWER

The normal violet flower is too well known to warrant a detailed description. However, for the sake of comparison with those of the peloric types, the essential characters will be briefly mentioned.

The calyx is composed of five sepals, three of which are plainly auricled. The corolla is composed of one saccate or spur bearing petal, which normally is situated at the base of the flower, and four others which are non-saccate. In addition to the saccate character, this petal is easily distinguished by its long and distinct, dark purplish inner striations. The androecium is composed of five stamens each of which bears a pair of anther-sacs. Only two stamens of the set of five bear a stamen-appendage. They are located one on each side of the saccate petal and the two appendages are enclosed in the one sac. The pistil is composed of three carpels with as many placentae to which the ovules are attached. The style has a decided dorso-ventral curvature immediately above the ovary and its gradual upward dilation ultimately forms the stigma. The pore-tube slants at a decidedly sharp angle with the longitudinal axis of the style.

These are the characters of the normal flower of *Viola primulaefolia* Linn. and are enumerated at this time merely for the sake of a contrast with similar ones found in the various peloric forms.

DESCRIPTION OF THE COMPLETE PELORIC FLOWERS AND THEIR CORRELATIONS

In view of the fact that two wonderful changes are taking place in the flowers of this violet plant, it might be well to repeat

that the phenomenon of peloria in *Viola primulaefolia* as described in this paper seems to involve not only a transformation of the irregular or unsymmetrical flower to one that is regular or symmetrical with respect to the transverse diameter of the



FIG. 2. A handful of violet flowers gathered from the new strain of *Viola primulaefolia*. Notice the variations in the numbers and positions of the saccate petals.

peduncle but also a reduction in the number of component parts of all of the floral envelopes, except the pistil, in which case the number is definitely increased. Therefore, the peloric flowers which are complete in their transformation including the changes resulting in the uniformity in numbers of the constituent parts of the floral whorls, may be described thus:

The calyx is composed of four equal sepals all of which are plainly auricled. The corolla is similarly composed of four equal petals all of which are saccate and true spur-petals in every essential including the interior striations. The androecium is composed of four stamens, each of which bears a pair of anther-sacs and one appendage. It is also noteworthy to mention that of the four sacs of the corolla, one encloses two stamen-appendages, or one from each of the two adjacent stamens, two enclose one appendage each and one apparently does not enclose any. The carpels are four in number with four equally developed placentae. The style immediately above the ovary is practically straight and a distinct dilated stigma with two lobes is formed at its distal extremity. The beak or pore-tube is situated in the center of the stigma and its longitudinal axis is in the same plane as that of the style. The opening of the pore-tube, instead of being circular in outline, is represented by what might be called an oblong orifice whose greater diameter lies at right-angles to that of the stigmatic lobes.

While this fully developed type of flower represents the extreme of variation, it is represented, in this case at least, in but a small percentage of the flowers.

DESCRIPTION OF INTERMEDIATE TYPES OF FLOWERS.

The intermediate flower types are quite variable and are represented by an infinite number of forms with respect to the number and arrangement of their constituent parts. They apparently form a complete series from that of the normal flower to that of the extreme peloric type. In the spring of 1920 a total of 573 flowers were picked quite at random and a study of these gave the following ratios: no saccate petals—0 flowers, one saccate petal—203 flowers, two saccate petals—157 flowers, three saccate petals—128 flowers, four, saccate petals—84 flowers, and five saccate petals—1 flower. A number of these flowers have been dissected and critically studied and as a result of the analyses it becomes possible to make the following deductions.

1. Each of the floral whorls may exhibit modifications inde-

pendent to some extent of the other whorls. For instance, we find flowers with four sepals, five petals, five stamens and three carpels; four sepals, four petals, five stamens and four carpels; four sepals, five petals, five stamens and four carpels; or such an arrangement as, five sepals, five petals, three stamens, and three carpels, and so on.

2. The constituent parts of the floral whorls may be modified independently of one another. Thus we find three or four sepals plainly auricled whenever five constitute the calyx, but when four or a less number of sepals constitute the calyx all of them are so auricled. One case was studied where five sepals were present and all of them were plainly auricled, another case where only three sepals constituted the calyx and all of them were so auricled.

In the corolla we find either one, two, three, four or even five petals saccate whenever five constitute the whorl. When only four petals are present all are saccate. Frequently petals are found that might be termed intermediate between the non-saccate and those that are plainly saccate. Normally the saccate petal in *Viola* is situated at the base of the flower but in this new type it may be found in the place of any one of the five petals, that is, on any one side of the flower. Whenever two or more saccate petals are present they may be found in any of the five different positions. Four saccate petals are usually found located opposite one another, thus forming a perfect square.

Among the stamens we find two, three or four that are appendaged whenever five constitute the androecium. Whenever four or a less number are present all of them usually are appendaged. It might be stated in this connection that the spur of generally one, sometimes two, saccate petals encloses one appendage of each of the two adjacent stamens. Again, all of the stamens may bear twin anther-sacs or, for instance, whenever four stamens constitute the androecium, one or two individuals may bear triple anther-sacs. A case of this kind was observed where two of the four stamens had three anther-sacs each and were situated on opposite sides of the androecium. Other cases were observed where only one of a set of four stamens had

the triple anther-sacs and two cases where but three stamens constituted the androecium. In these latter cases one of the three stamens bore the normal twin and the other two the triple anther-sacs. Again, two, three or four stamens may bear single

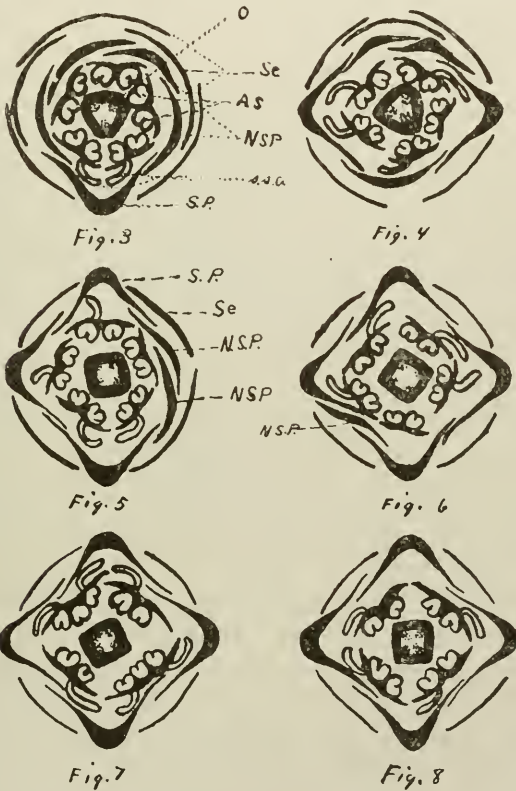


FIG. 3-9 incl. represent sketches of cross-sections of some of the modified flowers. Se., sepals; S. P., saccate petals; N. S. P., non-saccate petals; Tw. A. S. twin anther-sac stamen; Tr. A. S., triple anther-sac stamen; A. S., anther-sacs; s. s. a., single stamen appendage; t. s. a., twin stamen appendages; O., ovary with its placentae and ovules.

appendages or as in the case of the stamens that bear the triple anther-sacs, one or more may bear twin appendages.

The ovary may be composed of three or four carpels. The fourth carpel is often found in various stages of development.

3. A certain amount of correlation or interdependence seem-

ingly exists between the character and position of some of the constituent parts of one floral whorl and those of other whorls within the same flower. For instance, the saccate petal usually is correlated with an appendage affixed to one of the adjacent stamens; and the size of the sac seems correlated with the size and development of the enclosed appendages. Apparently an exception to this rule is found within the extreme peloric flowers where one saccate petal is regularly seemingly unaccompanied by the usually inclosed stamen appendage.

Another correlation that might be mentioned is one existing between the number of stamen appendages and the type of stamen; for instance, the twin appendages are always associated with the triple anther-sac stamen but these in turn need not always bear the twin appendages.

INHERITANCE OF PELORIA AND THE TENDENCY TOWARD NUMERICAL UNIFORMITY IN THE FLORAL WHORLS IN *VIOLA PRIMULAEFOLIA*

As soon as the plant bearing peloric flowers was discovered it was transplanted to a more suitable field where it continued to grow and develop seed. Some of the seeds were saved and planted in a flat where they germinated early in 1913. Sixteen plants were secured and later transplanted to an open field where they bloomed the following year. All of these plants produced flowers similar to those of the parent plant. The sixteen plants soon began to multiply by means of stolons and soon a patch or a solid mat of plants was formed. All of the plants originating from stolons also produced flowers quite similar to those of the parent plants. From time to time the matted patch was thinned of its superfluous and older plants and still the newest plants, even after a lapse of seven seasons, continued to produce flowers like those of the original plants.

EFFECT OF ENVIRONMENT ON PELORIA AND THE TENDENCY TOWARD NUMERICAL UNIFORMITY IN THE FLORAL WHORLS

Plants of this unique strain have been grown in a number of different places and under a variety of conditions for the purpose

of ascertaining what effect environment might have on the form of the flowers. Individual plants, in early spring and before much growth had taken place, were potted in good garden soil and grown indoors like ordinary house plants, others were bedded in similar soil supplied with a generous amount of fertil-

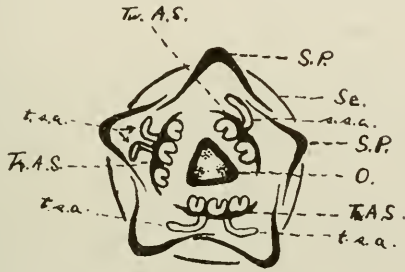


Fig. 9

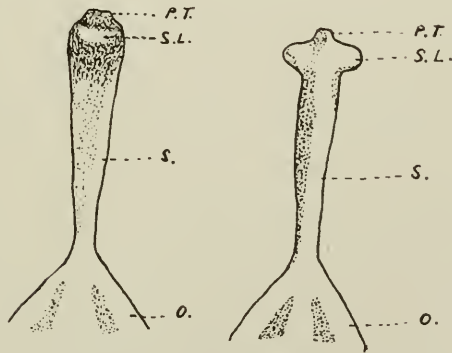


Fig. 10

Fig. 11.

FIG. 10 represents the style and stigma from a complete peloric flower, side view. P. T., pore-tube; S. L., stigmatic lobe; S., style; O., ovary. Fig. 11 represents the same style and stigma from a front view.

izing constituents and grown under greenhouse conditions and still others were grown in the muck soil of a damp or swampy area in the open field. The results in all cases were alike, all of the plants without exception produced the previously described peculiar flowers.

A FEW GENERAL REMARKS

The outstanding features of this new strain of *Viola* are:

1. It produces variable flowers which exemplify the connecting link between a 5-merous and a 4-merous flower.
2. It embodies the phenomenon of peloria which changes the flower from an unsymmetrical one to one that is perfectly symmetrical.
3. With respect to (1) and (2) it remains uniform under great differences of environment.
4. It apparently breeds true to type both vegetatively and sexually.
5. Because of (4) it might be truly termed a mutation.

Other generations of this interesting strain of violets will be grown and reported on as time will permit but since the seeds are borne in capsules of cleistogamous flowers they might be considered the result of self-fertilization and therefore succeeding generations might not differ materially from the first unless the strain throws other mutations.

AN EXCURSION TO MOUNTAIN LAKE, VIRGINIA

BY WILLIAM ALPHONSO MURRILL

Our party of six left Blacksburg, Virginia, for Mountain Lake at seven o'clock on the morning of July 22, 1920, prepared to spend the day. Clear weather had succeeded a season of rain and the hay-makers were busy in the fields along the road as we passed, while the oat crop stood ready for harvesting. Nature had not been stingy in any particular; everything planted in gardens and fields was growing and yielding most bountifully, while the last raspberries and dewberries and the first of the blackberries indicated an unusual abundance of wild food.

The first range we climbed and crossed was Brush Mountain, whose southern flank was covered with stunted pitch pine, bracken fern, sweet fern, and a wealth of *Coreopsis seniifolia*, with attractive yellow flowers and leaves arranged in whorls of sixes. From Brush Mountain to Gap Mountain was only a few minutes' ride, across a narrow stretch of sterile land very